

# **BIG CYPRESS NATIONAL PRESERVE FRESHWATER FISH INVENTORY AND MONITORING INTERIM REPORT**

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## **EXECUTIVE SUMMARY**

During the past year, we have conducted field sampling of the freshwater fishes of the Big Cypress National Preserve in accordance with the National Park Service's Inventory and Monitoring Program. As of November 2003, we have sampled 370 sites in Big Cypress. Samples have been taken across a range of forested and herbaceous wetland habitats, including cypress forests, mixed hardwood swamp forests, cypress prairies, herbaceous prairies, freshwater and coastal marshes, and canals.

Samples have been taken with a variety of methods, including traps, gill nets, cast nets, dip nets, angling, and electrofishing. Trapping and electrofishing have proven the most effective and have been the most widely used.

We have currently documented 64 fish species in freshwater habitats in Big Cypress. Of these, nine are nonindigenous species: Oscar (*Astronotus ocellatus*), Pike Killifish (*Belonesox belizanus*), Black Acara (*Cichlasoma bimaculatum*), Mayan Cichlid (*Cichlasoma urophthalmus*), Walking Catfish (*Clarias batrachus*), Jewel Cichlid (*Hemichromis letourneauxi*), Brown Hoplo (*Hoplosternum littorale*), Blue Tilapia (*Oreochromis aureus*), and Spotted Tilapia (*Tilapia mariae*). This study has been the first to document *Hemichromis* and *Hoplosternum* in the Preserve.

Canals supported the greatest diversity of species, with 62 of the 64 species present in Big Cypress occurring in this habitat. Many of these were euryhaline species penetrating from the Gulf of Mexico or were large, open-water freshwater species ill-suited to seasonal wetland habitats. Coastal marshes all supported a number of euryhalines due to their proximity to estuaries. The remaining freshwater wetland habitats shared similar fish fauna. Nearly half of the 33 species found in any of the seasonal freshwater wetland habitats were found to be present in all of them.

Our records, in combination with literature records for potential species for the Big Cypress, lead us to estimate that we have surpassed the I & M goal of documenting 90 percent of the freshwater fish species in the Preserve. This estimate of 67 species in total includes records of several species reported from Big Cypress by previous researchers but which we have not yet captured in this project. These include Diamond Killifish (*Adinia xenica*) Chain Pickerel (*Esox niger*), Naked Goby (*Gobiosoma bosc*), and Channel Catfish (*Ictalurus punctatus*). All of these species are likely of very limited distribution in the study area.

## **INTRODUCTION**

### Objectives

This project is intended to fulfill the needs of the NPS Inventory and Monitoring Program for freshwater fishes in the Big Cypress National Preserve. The I & M program is a national initiative to document 90% of the species of vertebrates and vascular plants found within NPS properties. Specifically, our objective is to inventory the freshwater fishes of Big Cypress National Preserve to provide geo-referenced information about fish composition, richness, and distribution in aquatic habitats within the Preserve boundaries.

### Geography/Climate

Big Cypress National Preserve is a low relief, seasonally inundated subtropical wetland. It is a portion of the geographic region known as the Big Cypress Swamp, which covers an extensive portion of southwest Florida. It is comprised of a heterogeneous array of forested and herbaceous wetlands interspersed with upland pine forests and deep-water ponds and sloughs (Figure 1). The preserve is also crisscrossed by an extensive system of canals that provide dry-season refuge and conduit for rapid movement of fishes. Many of these are introduced exotics or euryhaline species penetrating from the Ten Thousand Islands.

### Previous Studies

Little work had been done to systematically document the fishes of the Big Cypress Swamp. Kushlan (1974) observed and reported the effects of seasonal dry-down on the fishes of an alligator pond. Carson and Duever (1979) monitored fish populations in a cypress strand at Corkscrew Swamp through an annual wet-season-dry-season cycle. Fish sampling has also been conducted during the construction of the Jetport (now the Dade-Collier Transition and Training Airport) and during baseline studies of the BICY Addition Lands administrative unit (Evans 1970, Dalrymple 1995). The Conservancy of Southwest Florida is conducting a fish-monitoring program in Fakahatchee Strand and Golden Gate Estates, but results have not been published (David Ceily, pers. comm.). The most extensive sampling in the region to date was conducted by Loftus and Kushlan (1987), but focused on areas south of U. S. Highway 41.

## **METHODS**

Sampling was conducted according to a stratified design based on habitat types. The majority of sites were located within 250 meters of roads or trails passable by truck to simplify access. Sites were also reached by boat, all-terrain vehicle, helicopter, and airboat when these means of transportation were available. Habitat heterogeneity made random selection of sites difficult, particularly during the dry season, as no sufficiently detailed hydrology data existed to insure that randomly selected sites would be inundated. In those cases, sites were arbitrarily selected to insure the presence of standing surface water.

### Habitat Types

The habitat type classification scheme used was based on the seasonally inundated habitats identified by Duever et al (1986). Eight broad categories based on dominant vegetation and hydroperiod were used. Six of these are subject to seasonal drydown. They are ranked by hydroperiod as follows:

- Cypress forest- The dominant trees of Big Cypress, the bald cypress *Taxodium distichum* and pond cypress *T. ascendens*, are characteristic of this habitat. It includes both cypress domes and cypress strands. Hydroperiods in these areas are in excess of 240 days per year, and may be over 290 (NPS 1991).
- Mixed swamp forest- These are long hydroperiod forested wetlands which are dominated by hardwoods such as *Acer rubrum*, *Fraxinus caroliniana*, and *Annona glabra*. *Taxodium* is frequently present, but is not dominant, in these areas. Hydroperiods are in the range of 270 days per year (Duever et al 1986).
- Freshwater marshes- This habitat has hydroperiods of 150-250 days per year and is dominated by *Pontedaria* spp, *Sagittaria* spp, *Typha* spp and a variety of grasses and sedges (NPS 1991).
- Coastal marshes- Southwestern sections of Big Cypress include herbaceous wetlands that seasonally vary between fresh and brackish salinity regimes. Hydroperiods are similar to freshwater marshes. Dominant forms of vegetation include *Spartina spartinae*, *Distichlis spicata*, and *Eleocharis cellulosa* (NPS 1991).
- Cypress prairie- This community is characterized by an open overstory of sparsely distributed dwarf pond cypress. It often flanks and intergrades with cypress forests. Hydroperiods are approximately 120 days/year (NPS 1991).
- Herbaceous prairie- A variety of grasses dominate these areas, including *Muhlenbergia capillaris*, *Spartina bakerii*, *Cladium jamaicense*, *Panicum hemitomon*, and *Rhynchospora* spp.(Duever et al 1986). This is the shortest-hydroperiod habitat, with a maximum of 70 days wetted per year (NPS 1991).

Two additional habitats hold water year-round:

- Canals- Canals within or bordering on Big Cypress include Barron Collier canal, L28 Interceptor, L28, Loop Road Canal, and Tamiami Canal. They provide a refuge for large fishes during the dry season and allow for rapid movement across the Preserve, assisting in the spread of exotic species.
- Sloughs/ponds/rivers- This category includes all naturally occurring persistent water bodies in the preserve. Ponds and rivers cover only a small geographic extent of the Preserve, but include such features as Deep Lake, Mud Lake, and Turner River.

### Sampling Techniques

The diversity of habitat types in Big Cypress presents considerable challenges to the development of a comprehensive sampling regime, as the effectiveness of any given methodology varies between habitats. To compensate for this, numerous techniques have been employed during this study. A variety of fish traps have been used extensively, as well as electrofishing gear, gill nets, cast nets, dip nets, and angling.

**Traps:** Traps provide a means of sampling with a standardized unit of effort and are suitable for use in virtually any habitat. They are also relatively portable, and therefore suitable for work in remote locations. They have the disadvantage of having inherent selection biases, based both on trap construction, and size and behavior of targeted species. To attempt to minimize these, we deployed a variety of small-fish traps simultaneously. These included Gee-type minnow traps, box traps, collapsible mesh traps, and Breder traps. Details of these trap types are given in Table 1. Soak times were generally 24 hours, although one-hour sets were also performed. Small-fish traps were consistently fished unbaited and relied on passive encounters to generate captures.

Hoop nets were used to sample larger fishes in deeper water. They were fished unbaited with or without leads, and were also baited with cheese to selectively target catfish species that had proved difficult to obtain otherwise. The hoop nets used here were 1.4 meters in overall length and were constructed from four 50-cm diameter fiberglass hoops and tar-coated twine with a 2.5 cm mesh size. The nets had two throats and an approximately 15 cm diameter aperture. Typically, hoop nets were deployed for 24-hour intervals.

**Electrofishing:** Electrofishing was conducted in locations where habitat composition allowed. Two electrofishing setups were used. The first utilized a boat-mounted Smith-Root type 6A electrofisher with a maximum current output of 1008 volts DC at 120 pulses per second or 720 volts AC at 60 hertz. It was used extensively for sampling in canals but was too large to penetrate into other habitats. Effort was generally standardized by conducting 100-meter transects, although opportunistic sampling around structures such as bridge pilings was conducted as well.

Forested habitats and marshes were sampled using a small barge carrying a Smith-Root model 2.5 GPP electrofisher with a maximum current of 1000 volts at either 120 pulses per second DC or 60 hertz AC. The barge drew only several centimeters of water and was only a meter wide, but still could not penetrate into heavily vegetated habitats. Samples were standardized to 300 seconds of total shock time.

**Nets:** Experimental gill nets were used to sample canal fishes. Two nets each composed of 4 242 cm deep x 180 wide cm panels were fished in tandem. The first had mesh sizes of 1.2, 2.5, 3.7, and 5cm while the second was composed of panels with mesh of 6.2, 7.6, 8.8, and 11 cm. Nets were typically set from 1 to 4 hours. Reptile entanglements were problematic when using these nets. Encounters with alligators were particularly damaging, precluding longer sets.

While unsuitable for providing quantitative data, cast nets were used extensively in an opportunistic fashion to capture species sighted in canals. The cast nets had a radius of 180 cm and a 1.2 cm mesh size. Dip nets were used for sampling in dense vegetation. These nets had fine mesh (<1mm) and were the most effective method for collecting small species, such as least killifish (*Heterandria formosa*) and Everglades pygmy sunfish (*Elassoma evergladei*).

**Other:** Opportunistic sampling was conducted using light tackle hook-and-line fishing with a variety of lures and live or dead baits. Lines of baited hooks were also occasionally deployed in canals in attempts to catch catfish, although hoop nets proved substantially more effective. Finally, sight records were kept for any species observed in the field that could be positively identified without being captured.

### Measurements

We recorded the location of each sampling site as universal transverse mercator coordinates using a Garmin Etrex Vista GPS. For each sample, all specimens were identified to species, and total catch per species recorded. We measured total lengths for the first 20 randomly selected individuals of each species to obtain a representative size distribution. Water temperature, pH, salinity, and dissolved oxygen were measured for each site when possible, however, instrumentation problems precluded this for much of the year. Recently, we borrowed a Hydrolab 4a minisonde and datalogger from the BICY hydrology department to resolve these problems. For electrofishing expeditions, water conductivity was determined using a YSI-33 conductivity meter.

### Data Input/Analysis/Reporting

All field data were recorded on paper datasheets or, in the event of poor weather, into waterproof-paper notebooks. Datasheets were transcribed into an MS Access database, with linked tables for site location, physical parameters, and catch information. Each sample was given a unique numeric identifier to allow for the automated generation of reports on each sampling expedition. Exporting Access data to Arcview GIS software and comparing a sample's map location with its known physical location proofed geographical information. We compared Access site reports to field notes to control the quality of the remainder of the data-entry process.

### Voucher Specimens

We collected and curated representative vouchers for all captured species whenever practical. Specimens too large to effectively preserve have been documented photographically. Vouchers have been collected independently for each habitat type sampled. Additionally, to ensure complete spatial coverage of the preserve, vouchers of each species have been collected from the north, central, and southern regions of Big Cypress (Figure 2). Information regarding each voucher was entered into the project Access database, and each was assigned a unique identifier to link with related sampling information. Voucher collection is an ongoing process and will continue for the duration of the study. Specimens too large for preservation have been documented using a digital camera. The present status of the voucher collection is shown in Table 2. Upon completion of this project, vouchers will be transferred to an NPS-identified repository.

## **RESULTS AND DISCUSSION**

Currently, we have sampled at 370 sites throughout Big Cypress National Preserve (Figure 3). The distribution of these sites among habitats is shown in Table 3. Canals were the most widely sampled habitat, however, the effort involved in many of these samples was lower than that for natural habitats, as sites often consisted of a single hoop net set or electrofishing transect.

Frequency of sampling in each habitat type was based roughly upon a combination of geographic extent within the preserve and hydroperiod. Coastal marshes and tidally influenced canals were sampled only when salinities were less than one part per thousand. These conditions prevailed in most locations from June to October. To date, a

total of 64 fish species have been documented from freshwater habitats within Big Cypress National Preserve (Table 4).

#### Distribution by Habitat Type

Table 5 shows the occurrence or absence of each species from samples collected in each of the major habitats previously detailed. Canals held by far the most diverse assemblage. Sixty-two of the 64 species documented in the Preserve occurred within this habitat. Although this is partially an artifact of the greater sampling effort employed in canals relative to other habitats, it also reflects the presence of euryhaline species penetrating from the Gulf of Mexico. Many of these are most likely only temporary residents and probably do not enter wetland habitats other than visiting channels in coastal marshes. Species in this category include the various needlefish (*Strongylura* spp.), mojarra (*Eugerres* & *Eucinostomus*), and gobies (*Bathygobius*, *Lophogobius* & *Microgobius*) as well as Hardhead Catfish (*Arius felis*), Sheepshead (*Archosargus probatocephalus*), Creville Jack (*Caranx hippos*), Snook (*Centropomus undecimalis*), Sharksucker (*Echeneis naucrates*), Pinfish (*Lagodon rhomboides*), Gray Snapper (*Lutjanus griseus*) and Tarpon (*Megalops atlanticus*). Also, several fish found in canal samples are freshwater species that prefer deep-water habitats and are therefore also unlikely in wetlands. These include Brown Bullhead (*Ameiurus nebulosus*), Gizzard Shad (*Dorsoma cepedianum*), and Black Crappie (*Pomoxis nigromaculatus*).

Sloughs, ponds, and rivers are the only naturally occurring habitats in the Preserve that are generally not subjected to seasonal dry-down. There is very little natural river drainage of the Big Cypress National Preserve, although the Turner River drains the southwestern portion and allows passage inland to euryhaline wanderers in the same manner as canals. Lakes are also infrequent features of Big Cypress, however, they provide refuge to large euryhaline species, particularly if they have a hydrologic connection to the canal system. The best example of this is the substantial population of Tarpon (*Megalops atlanticus*) inhabiting Deep Lake, a flooded sinkhole adjacent to the Barron Collier Canal. It appears that these individuals are now permanent residents of the lake and some are quite large. It is unclear how long they have lived there, or how much interchange there currently is with marine populations.

Coastal marshes are also visited by a number of euryhaline species, and during the wet season, support most of the freshwater species found in the Preserve as well. Euryhaline species present in this habitat include Clown Goby (*Microgobius gulosus*), Gulf Killifish (*Fundulus grandis*), Rainwater Killifish (*Lucania parva*), and Striped Mullet (*Mugil cephalus*).

The remaining wetland habitats share very similar fish fauna. Of the 33 species found in any of these habitats, 16 were common to all. It is likely that several other species are present in all habitats as well, but have not yet been captured in all. There is probably some degree of habitat preference inherent to each species based on such factors as size, diet, and life history; however it was not our objective to quantify those here. There seems to be a general preference among small fish species to utilize shallow-water areas such as herbaceous prairies and cypress prairies when these habitats are inundated. The relative abundance of these species in swamp forests and cypress strands appears to increase when adjacent prairie habitats dry down. This is similar to information reported by Carlson and Duever (1979) for Flagfish (*Jordanella floridae*) and Least Killifish

(*Heterandria formosa*) populations during the annual dry-down of Corkscrew Swamp (1979).

### Non-indigenous Species

Nine species of introduced fishes were found in the Preserve: Oscar (*Astronotus ocellatus*), Pike Killifish (*Belonesox belizanus*), Black Acara (*Cichlasoma bimaculatum*), Mayan Cichlid (*Cichlasoma urophthalmus*), Walking Catfish (*Clarias batrachus*), Jewel Cichlid (*Hemichromis letourneauxi*), Brown Hoplo (*Hoplosternum littorale*), Blue Tilapia (*Oreochromis aureus*), and Spotted Tilapia (*Tilapia mariae*). *Hemichromis* and *Hoplosternum* had not been previously recorded from Big Cypress and appear to be recently established here. The most widely distributed of these species are Pike Killifish, Mayan Cichlids, Black Acara, and Spotted Tilapia. Oscar, Walking Catfish, and Blue Tilapia were captured almost exclusively in or adjacent to canals or other deep-water habitats, although their distribution in the Preserve may be greater than this. Brown Hoplos and Jewel Cichlids were infrequently encountered, but each has been captured or reported by collaborators in wetland habitats.

### Methods Testing

The heterogeneity of the aquatic habitats resulted in no single sampling method being found suitable to provide a complete picture of fish-community structure in any habitat. We were not permitted to use toxicants such as rotenone in enclosed areas to establish baseline-community profiles, which also hampered efforts to determine the efficiencies of each method to sample fish populations within each habitat. However, the data collected during this study may be used to draw some general conclusions about the effectiveness of various techniques. Also, we believe that efficiency tests performed for methods, such throw traps and drop traps, done in Everglades habitat structure similar to that of the Preserve habitats, will be similarly effective in trapping fish and invertebrates here.

Small-fish trap sets with minnow and Breder traps have been used most extensively in wetland environments. Table 6 shows the list of species obtained using this technique. A total of 36 species have been captured using traps. Of the 39 species appearing in Table 5 as occurring in wetland habitats, 35 have been obtained in trap sets. The only documented wetland species not present in the trap data are Brook Silverside (*Labidesthes sicculus*), Clown Goby (*Microgobius gulosus*), Golden Shiner (*Notemigonus crysoleucas*), and Striped Mullet (*Mugil cephalus*). These have been taken with a combination of dip netting, gill nets, and electrofishing. While trap data may not necessarily provide good estimates of relative or absolute abundances, their ability to capture such a broad cross-section of species, combined with their ease of transportation and use, suggest they are the best available method for providing presence/absence data on fish species in Big Cypress wetlands, especially if supplemented with opportunistic dip netting.

Electrofishing has proven to be the most effective method for censusing fishes in open-water areas. A total of 45 species have been taken during electrofishing surveys (Table 7). Demersal species, such as catfish, have proven difficult to obtain with this technique, so canal sampling should also include the use of baited hoop nets. Gill nets are also useful in canals and deep-water areas, however the large population of alligators

in Big Cypress makes entanglements a virtual certainty. This could result in both unwanted destruction of alligators and serious damage to nets.

## **TOPICS OF CONCERN**

### Undocumented Species:

Several species have been documented by previous researchers in the Preserve but have not been found in our samples. Loftus (1987) found Diamond Killifish (*Adinia xenica*) and Naked Goby (*Gobiosoma bosc*). Dalrymple's 1995 survey of the Addition Lands administrative area included reports of Chain Pickerel (*Esox niger*) and Channel Catfish (*Ictalurus punctatus*) in the L-28 Canal. While none of these species appear to be widespread in the Preserve, we still hope to obtain collections of them through future work.

Based on their presence in nearby areas, it is also possible that Threadfin Shad (*Dorosoma petenense*), Pirate Perch (*Aphredoderus sayanus*), Jaguar Guapote (*Cichlasoma managuense*), and Sailfin Catfish (*Pterygoplichthys* spp.) may yet be found in the Preserve. A complete list of species likely to be found in Big Cypress is given in Appendix 1.

Between our records and the species previously documented from the Preserve, in comparison with all species we think are reasonably likely to occur, we estimate that we have documented 92 percent of the ichthyofauna of the Preserve.

## **ACKNOWLEDGEMENTS:**

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Table 1: details of small-fish traps used in BICY sampling

trap type	material	mesh size	min. depth	aperture size	dimensions
box trap	wire	6 mm	12 cm	3cm	20 cm x 40 cm x 46 cm rectangular
breder trap	acrylic	n/a	1 cm	1cm	30 cm x 15 cm x 15 cm rectangular, 2 30cm wings
mesh trap	nylon	2 mm	13 cm	6 cm	44 cm x 25 cm x 25 cm rectangular
gee-type trap	wire	6 mm	12 cm	2.5 cm	43 cm x 22 cm diameter cylindrical

Table 2: current status of BICY voucher collection

	north						central						south										
	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	canals	freshwater marsh	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	coastal marshes	canals	freshwater marsh	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	coastal marshes	canals	freshwater marsh
American Eel	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-
Atlantic Needlefish	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Black Acara	-	X	-	-	-	-	-	X	-	X	-	-	-	X	-	-	-	-	-	-	X	X	X
Black Crappie	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Blue Tilapia	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	X	-	X	X	X	-
Bluefin Killifish	-	-	-	-	-	X	X	X	X	-	X	-	-	X	-	X	-	-	X	-	-	X	X
Bluegill	-	X	-	-	-	X	-	X	-	-	-	-	-	X	-	X	-	-	-	-	-	-	-
Bluespotted Sunfish	-	X	-	-	-	-	X	-	-	-	-	X	-	X	-	X	-	-	X	X	-	X	X
Bowfin	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brook Silverside	-	-	-	-	-	-	-	X	-	-	-	X	-	X	-	-	-	-	X	-	-	X	-
Brown Bullhead	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Brown Hoplo	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Clown Goby	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	-	-
Coastal Shiner	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-
Crested Goby	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-
Crevalle Jack	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dollar Sunfish	-	X	-	-	-	X	-	X	-	X	X	-	-	X	-	X	-	X	X	X	-	X	X
Everglades Pygmy Sunfish	-	-	-	-	-	X	-	-	X	-	X	-	-	X	-	X	-	-	-	-	-	X	-
Flagfish	X	X	-	-	-	-	X	-	-	X	X	-	-	X	-	-	-	X	X	-	X	X	-
Florida Gar	-	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-	X	-	-	-	X	-
Frillfinned Goby	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Gizzard Shad	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Golden Shiner	-	-	-	-	-	X	-	-	-	-	-	X	-	X	-	-	-	-	-	-	-	X	-
Golden Topminnow	X	-	-	-	-	X	-	X	-	X	X	-	-	X	-	-	-	X	-	-	-	X	-
Gray Snapper	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Gulf Killifish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Hardhead Catfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hogchoker	-	-	-	-	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	X	-	X	-
Inland Silverside	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	X	-
Jewel Cichlid	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	X	-	-	-	-
Ladyfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Lake Chubsucker	-	-	-	-	-	X	-	X	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Largemouth Bass	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	X	-	-	-	-	-	X	-

Table 2 cont.

	north							central							south								
	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	canals	freshwater marsh	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	coastal marshes	canals	freshwater marsh	cypress forest	mixed swamp forest	cypress prairie	herbaceous prairie	sloughs/ponds/rivers	coastal marshes	canals	freshwater marsh
Least Killifish	-	X	-	-	-	X	X	-	-	-	-	-	-	X	-	-	-	X	-	-	-	X	-
Marsh Killifish	-	-	-	-	-	-	-	X	-	-	X	-	-	X	-	-	-	X	X	X	X	-	-
Mayan Cichlid	-	-	-	-	-	-	-	X	-	X	X	X	-	X	-	-	-	X	X	X	X	X	X
Mosquitofish, Eastern	X	-	-	-	-	X	X	X	-	X	X	X	-	X	-	-	-	X	X	-	X	X	X
Oscar	-	-	-	-	-	-	-	-	-	-	X	-	-	X	-	-	-	-	-	-	-	-	-
Pike Killifish	-	-	-	-	-	X	-	X	-	X	X	-	-	X	-	X	-	X	X	-	-	X	X
Pinfish	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Rainwater Killifish	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	X	X	X	-
Red Drum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Redear	-	-	-	-	-	X	-	X	-	-	-	-	-	X	-	X	-	X	-	-	-	X	X
Redfin Needlefish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-
Redfin Pickerel	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sailfin Molly	X	X	-	-	-	X	-	-	-	X	-	-	-	X	-	X	-	X	X	X	X	X	-
Seminole Killifish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	X	X
Sharksucker	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sheepshead	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Sheepshead Minnow	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	X	-	X	X	-	-
Snook	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-
Spotted Sunfish	X	X	-	-	-	X	-	X	-	-	-	-	-	X	-	X	-	X	X	X	-	X	X
Spotted Tilapia	-	-	-	-	-	-	-	X	-	-	-	X	-	X	-	-	-	X	-	-	-	X	X
Striped Mojarra	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Striped Mullet	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Swamp Darter	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
Tadpole Madtom	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taillight Shiner	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Tarpon	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tidewater Mojarra	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	X	-
Timucu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-
Walking Catfish	-	-	-	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	X	X	-
Warmouth	-	X	-	-	-	X	X	X	-	X	X	-	-	X	-	X	-	X	X	X	X	X	X
Yellow Bullhead	-	-	-	-	-	-	-	X	-	-	X	-	-	X	X	-	-	-	-	-	-	-	-

Table 3: sampling locations by habitat type

habitat	# of samples
canals	155
cypress forest	49
freshwater marsh	42
herbaceous prairie	33
sloughs/ponds/rivers	25
cypress prairie	15
mixed swamp forest	14
coastal marshes	10

Table 4: BICY freshwater fish species captured during the report period

<u>Species Name</u>	<u>Common Name</u>
<i>Ameiurus natalis</i>	Yellow Bullhead
<i>Ameiurus nebulosus</i>	Brown Bullhead
<i>Amia calva</i>	Bowfin
<i>Anguilla rostrata</i>	American Eel
<i>Archosargus probatocephalus</i>	Sheepshead
<i>Arius felis</i>	Hardhead Catfish
<i>Astronotus ocellatus</i>	Oscar
<i>Bathygobius soporator</i>	Frillfinned Goby
<i>Belonesox belizanus</i>	Pike Killifish
<i>Caranx hippos</i>	Crevalle Jack
<i>Centropomus undecimalis</i>	Snook
<i>Cichlasoma bimaculatum</i>	Black Acara
<i>Cichlasoma urophthalmus</i>	Mayan Cichlid
<i>Clarias batrachus</i>	Walking Catfish
<i>Cyprinodon variegatus</i>	Sheepshead Minnow
<i>Dorsoma cepedianum</i>	Gizzard Shad
<i>Echeneis naucrates</i>	Sharksucker
<i>Elassoma evergladei</i>	Everglades Pygmy Sunfish
<i>Elops saurus</i>	Ladyfish
<i>Enneacanthus gloriosus</i>	Bluespotted Sunfish
<i>Erimyzon sucetta</i>	Lake Chubsucker
<i>Esox americanus</i>	Redfin Pickerel
<i>Etheostoma fusiforme</i>	Swamp Darter
<i>Eucinostomus harengulus</i>	Tidewater Mojarra
<i>Eugerres plumieri</i>	Striped Mojarra
<i>Fundulus chrysotus</i>	Golden Topminnow
<i>Fundulus confluentus</i>	Marsh Killifish
<i>Fundulus grandis</i>	Gulf Killifish
<i>Fundulus seminolis</i>	Seminole Killifish
<i>Gambusia holbrooki</i>	Eastern Mosquitofish
<i>Hemichromis letourneauxi</i>	Jewel Cichlid
<i>Heterandria formosa</i>	Least Killifish
<i>Hoplosternum littorale</i>	Brown Hoplo
<i>Jordanella floridae</i>	Flagfish
<i>Labidesthes sicculus</i>	Brook Silverside
<i>Lagodon rhomboides</i>	Pinfish
<i>Lepisosteus platyrhincus</i>	Florida Gar
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis macrochirus</i>	Bluegill
<i>Lepomis marginatus</i>	Dollar Sunfish
<i>Lepomis microlophus</i>	Redear
<i>Lepomis punctatus</i>	Spotted Sunfish
<i>Lophogobius cyprinoides</i>	Crested Goby
<i>Lucania goodei</i>	Bluefin Killifish

Table 4 cont.

<u>Species Name</u>	<u>Common Name</u>
<i>Lucania parva</i>	Rainwater Killifish
<i>Lutjanus griseus</i>	Gray Snapper
<i>Megalops atlanticus</i>	Tarpon
<i>Menidia beryllina</i>	Inland Silverside
<i>Microgobius gulosus</i>	Clown Goby
<i>Micropterus salmoides</i>	Largemouth Bass
<i>Mugil cephalus</i>	Striped Mullet
<i>Notemigonus crysoleucas</i>	Golden Shiner
<i>Notropis maculatus</i>	Taillight Shiner
<i>Notropis petersoni</i>	Coastal Shiner
<i>Noturus gyrinus</i>	Tadpole Madtom
<i>Oreochromis aureus</i>	Blue Tilapia
<i>Poecilia latipinna</i>	Sailfin Molly
<i>Pomoxis nigromaculatus</i>	Black Crappie
<i>Sciaenops ocellatus</i>	Red Drum
<i>Strongylura marina</i>	Atlantic Needlefish
<i>Strongylura notata</i>	Redfin Needlefish
<i>Strongylura timucu</i>	Timucu
<i>Tilapia mariae</i>	Spotted Tilapia
<i>Trinectes maculatus</i>	Hogchoker

Table 5: species distribution by habitat type

species:	canals	sloughs, ponds, and rivers	mixed swamp forest	freshwater marsh	cypress forest	cypress prairie	herbaceous prairie	coastal marshes	all wetlands	freshwater wetlands	deep-water habitats only
American Eel	X	X	-	-	-	-	-	-	-	-	X
Atlantic Needlefish	X	-	-	-	-	-	-	-	-	-	X
Black Acara	X	X	X	X	X	X	X	X	X	X	-
Black Crappie	X	-	-	-	-	-	-	-	-	-	X
Blue Tilapia	X	X	-	X	X	X	-	X	X	X	-
Bluefin Killifish	X	X	X	X	X	X	X	X	X	X	-
Bluegill	X	X	X	X	X	-	-	X	X	X	-
Bluespotted Sunfish	X	X	X	X	X	-	X	X	X	X	-
Bowfin	X	X	-	-	X	-	-	-	X	X	-
Brook Silverside	X	X	-	X	X	X	X	-	X	X	-
Brown Bullhead	X	-	-	-	-	-	-	-	-	-	X
Brown Hoplo	X	-	-	-	-	-	-	-	-	-	X
Clown Goby	X	-	-	-	-	-	-	X	X	-	-
Coastal Shiner	X	-	-	-	-	-	-	-	-	-	X
Crested Goby	X	-	-	-	-	-	-	-	-	-	X
Crevalle Jack	X	-	-	-	-	-	-	-	-	-	X
Dollar Sunfish	X	X	X	X	X	X	X	X	X	X	-
Everglades Pygmy Sunfish	X	X	X	X	X	-	X	-	X	X	-
Flagfish	X	X	X	X	X	X	X	X	X	X	-
Florida Gar	X	X	X	X	X	X	X	-	X	X	-
Frillfinned Goby	X	-	-	-	-	-	-	-	-	-	X
Gizzard Shad	X	-	-	-	-	-	-	-	-	-	X
Golden Shiner	X	X	X	X	-	-	-	-	X	X	-
Golden Topminnow	X	X	X	X	X	X	X	X	X	X	-
Gray Snapper	X	-	-	-	-	-	-	-	-	-	X
Gulf Killifish	X	-	-	-	-	-	-	X	X	-	-
Hardhead Catfish	X	-	-	-	-	-	-	-	-	-	X
Hogchoker	X	X	-	-	-	-	-	X	X	-	-
Inland Silverside	X	-	-	-	-	-	-	X	X	-	-
Jewel Cichlid	X	-	-	X	-	-	X	-	X	X	-
Ladyfish	X	-	-	-	-	-	-	-	-	-	X
Lake Chubsucker	X	X	-	-	X	-	-	-	X	X	-
Largemouth Bass	X	X	X	X	X	X	X	X	X	X	-
Least Killifish	X	X	X	X	X	X	X	-	X	X	-
Marsh Killifish	X	X	X	X	X	X	X	X	X	X	-
Mayan Cichlid	X	X	X	X	X	X	X	X	X	X	-



Table 5 cont.

species:	canals	sloughs, ponds, and rivers	mixed swamp forest	freshwater marsh	cypress forest	cypress prairie	herbaceous prairie	coastal marshes	all wetlands	freshwater wetlands	deep-water habitats only
Mosquitofish, Eastern	X	X	X	X	X	X	X	X	X	X	-
Oscar	X	X	-	-	-	-	X	-	X	X	-
Pike Killifish	X	X	X	X	X	X	X	X	X	X	-
Pinfish	X	-	-	-	-	-	-	-	-	-	X
Rainwater Killifish	X	X	-	-	-	-	-	X	X	-	-
Red Drum	X	-	-	-	-	-	-	-	-	-	X
Redear	X	X	X	X	X	X	-	X	X	X	-
Redfin Needlefish	X	-	-	-	-	-	-	-	-	-	X
Redfin Pickerel	-	-	-	-	X	-	-	-	X	X	-
Sailfin Molly	X	X	X	X	X	X	X	X	X	X	-
Seminole Killifish	X	X	-	X	-	-	-	-	X	X	-
Sharksucker	X	-	-	-	-	-	-	-	-	-	X
Sheepshead	X	-	-	-	-	-	-	-	-	-	X
Sheepshead Minnow	X	-	-	X	-	-	X	X	X	X	-
Snook	X	X	-	-	-	-	-	-	-	-	X
Spotted Sunfish	X	X	X	X	X	X	X	-	X	X	-
Spotted Tilapia	X	X	X	X	X	X	X	X	X	X	-
Striped Mojarra	X	X	-	-	-	-	-	-	-	-	X
Striped Mullet	X	X	-	-	-	-	-	X	X	-	-
Swamp Darter	X	-	-	-	-	-	-	-	-	-	X
Tadpole Madtom	-	-	X	-	-	-	-	-	X	X	-
Taillight Shiner	X	-	-	-	-	-	-	-	-	-	X
Tarpon	X	X	-	-	-	-	-	-	-	-	X
Tidewater Mojarra	X	-	-	-	-	-	-	-	-	-	X
Timucu	X	-	-	-	-	-	-	-	-	-	X
Walking Catfish	X	X	X	-	-	-	-	X	X	X	-
Warmouth	X	X	X	X	X	X	X	X	X	X	-
Yellow Bullhead	X	X	-	X	X	-	X	-	X	X	-
total	62	36	23	27	26	19	23	25	39	33	25

Table 6: species captured by small-fish traps

Species Name	Common Name	trap type			
		box	breder	gee	mesh
<i>Ameiurus natalis</i>	Yellow Bullhead	X	-	X	-
<i>Amia calva</i>	Bowfin	X	-	-	-
<i>Astronotus ocellatus</i>	Oscar	X	X	X	-
<i>Bathygobius soporator</i>	Frillfinned Goby	X	-	-	-
<i>Belonesox belizanus</i>	Pike Killifish	X	X	X	X
<i>Cichlasoma bimaculatum</i>	Black Acara	X	X	X	X
<i>Cichlasoma urophthalmus</i>	Mayan Cichlid	X	X	X	X
<i>Clarias batrachus</i>	Walking Catfish	X	-	-	-
<i>Cyprinodon variegatus</i>	Sheepshead Minnow	X	X	X	X
<i>Elassoma evergladei</i>	Everglades Pygmy Sunfish	-	X	-	X
<i>Enneacanthus gloriosus</i>	Bluespotted Sunfish	X	X	X	X
<i>Esox americanus</i>	Redfin Pickerel	X	-	-	-
<i>Eugerres plumieri</i>	Striped Mojarra	X	-	-	-
<i>Fundulus chrysotus</i>	Golden Topminnow	X	X	X	X
<i>Fundulus confluentus</i>	Marsh Killifish	X	X	X	X
<i>Fundulus grandis</i>	Gulf Killifish	X	X	-	-
<i>Gambusia holbrooki</i>	Eastern Mosquitofish	X	X	X	X
<i>Hemichromis letourneauxi</i>	Jewel Cichlid	-	-	X	-
<i>Heterandria formosa</i>	Least Killifish	-	X	-	X
<i>Jordanella floridae</i>	Flagfish	X	X	X	X
<i>Lepisosteus platyrhincus</i>	Florida Gar	X	-	X	-
<i>Lepomis gulosus</i>	Warmouth	X	X	X	X
<i>Lepomis macrochirus</i>	Bluegill	X	X	-	-
<i>Lepomis marginatus</i>	Dollar Sunfish	X	X	X	X
<i>Lepomis microlophus</i>	Redear	X	X	X	-
<i>Lepomis punctatus</i>	Spotted Sunfish	X	X	X	X
<i>Lophogobius cyprinoides</i>	Crested Goby	X	-	X	-
<i>Lucania goodei</i>	Bluefin Killifish	X	X	-	X
<i>Lucania parva</i>	Rainwater Killifish	X	X	X	X
<i>Menidia beryllina</i>	Inland Silverside	-	X	-	X
<i>Micropterus salmoides</i>	Largemouth Bass	X	X	-	-
<i>Noturus gyrinus</i>	Tadpole Madtom	X	-	X	-
<i>Oreochromis aureus</i>	Blue Tilapia	X	-	X	X
<i>Poecilia latipinna</i>	Sailfin Molly	X	X	X	X
<i>Tilapia mariae</i>	Spotted Tilapia	X	X	X	X
<i>Trinectes maculatus</i>	Hogchoker	X	-	-	-
total:		32	24	23	20

Table 7: species captured by electrofishing

<u>Species Name</u>	<u>Common Name</u>
<i>Ameiurus natalis</i>	Yellow bullhead
<i>Amia calva</i>	Bowfin
<i>Anguilla rostrata</i>	American eel
<i>Archosargus probatocephalus</i>	Sheepshead
<i>Astronotus ocellatus</i>	Oscar
<i>Belonesox belizanus</i>	Pike killifish
<i>Centropomus undecimalis</i>	Snook
<i>Cichlasoma bimaculatum</i>	Black acara
<i>Cichlasoma urophthalmus</i>	Mayan cichlid
<i>Clarias batrachus</i>	Walking catfish
<i>Cyprinodon variegatus</i>	Sheepshead minnow
<i>Dorsoma cepedianum</i>	Gizzard shad
<i>Elassoma evergladei</i>	Everglades pygmy sunfish
<i>Enneacanthus gloriosus</i>	Bluespotted sunfish
<i>Erimyzon sucetta</i>	Lake chubsucker
<i>Etheostoma fusiforme</i>	Swamp darter
<i>Eugerres plumieri</i>	Striped mojarra
<i>Fundulus chrysotus</i>	Golden topminnow
<i>Fundulus confluentus</i>	Marsh killifish
<i>Fundulus seminolis</i>	Seminole killifish
<i>Gambusia holbrooki</i>	Eastern Mosquitofish
<i>Hemichromis letourneauxi</i>	Jewel cichlid
<i>Heterandria formosa</i>	Least killifish
<i>Jordanella floridae</i>	Flagfish
<i>Labidesthes sicculus</i>	Brook silverside
<i>Lepisosteus platyrhincus</i>	Florida gar
<i>Lepomis gulosus</i>	Warmouth
<i>Lepomis macrochirus</i>	Bluegill
<i>Lepomis marginatus</i>	Dollar sunfish
<i>Lepomis microlophus</i>	Redear
<i>Lepomis punctatus</i>	Spotted sunfish
<i>Lophogobius cyprinoides</i>	Crested goby
<i>Lucania goodei</i>	Bluefin killifish
<i>Lutjanus griseus</i>	Gray snapper
<i>Menidia beryllina</i>	Inland silverside
<i>Micropterus salmoides</i>	Largemouth bass
<i>Mugil cephalus</i>	Striped Mullet
<i>Notemigonus crysoleucas</i>	Golden shiner
<i>Notropis maculatus</i>	Taillight shiner
<i>Notropis petersoni</i>	Coastal shiner
<i>Oreochromis aureus</i>	Blue tilapia
<i>Poecilia latipinna</i>	Sailfin molly
<i>Tilapia mariae</i>	Spotted tilapia
<i>Trinectes maculatus</i>	Hogchoker

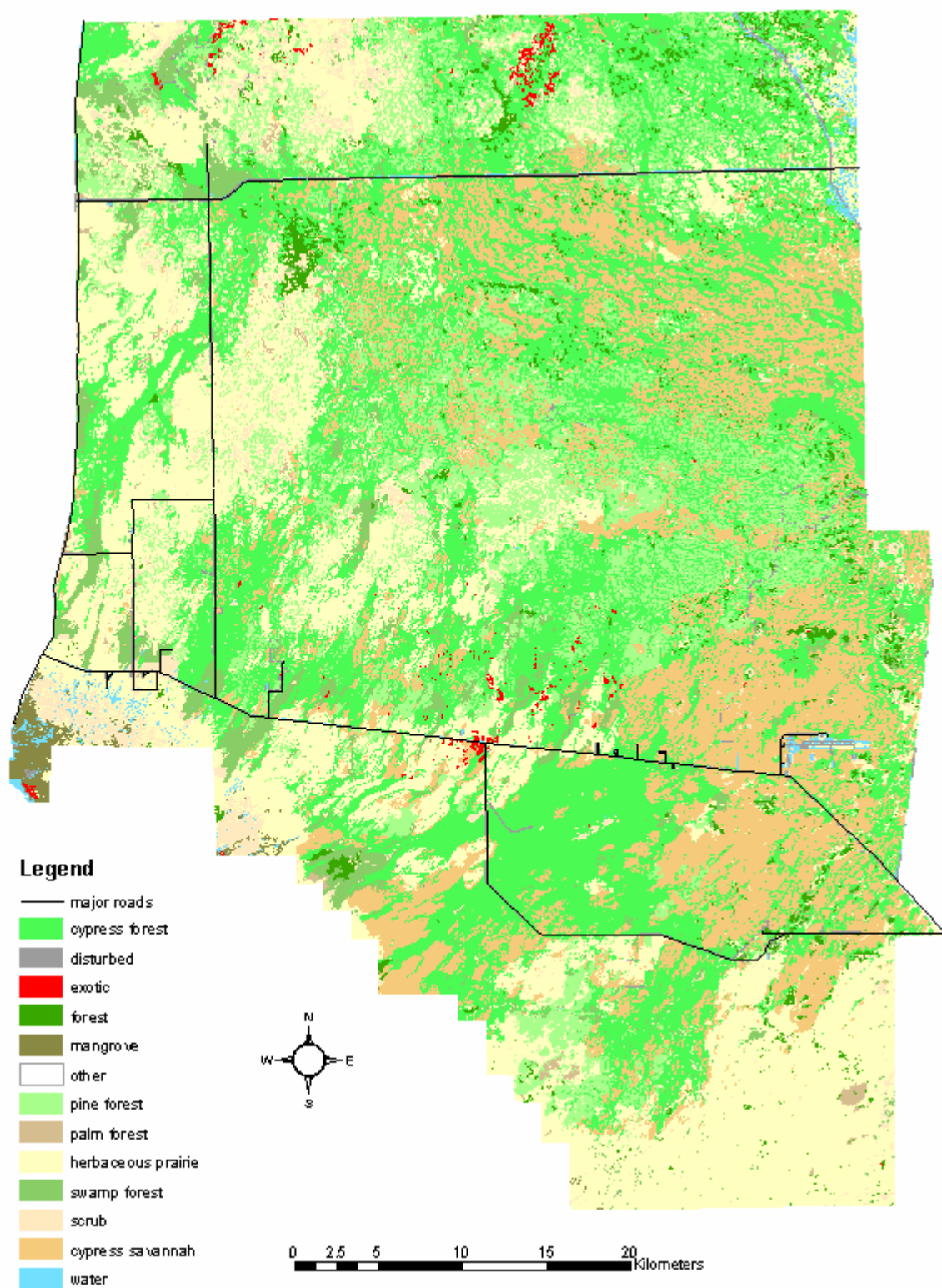


Figure 1: principal habitats of Big Cypress National Preserve

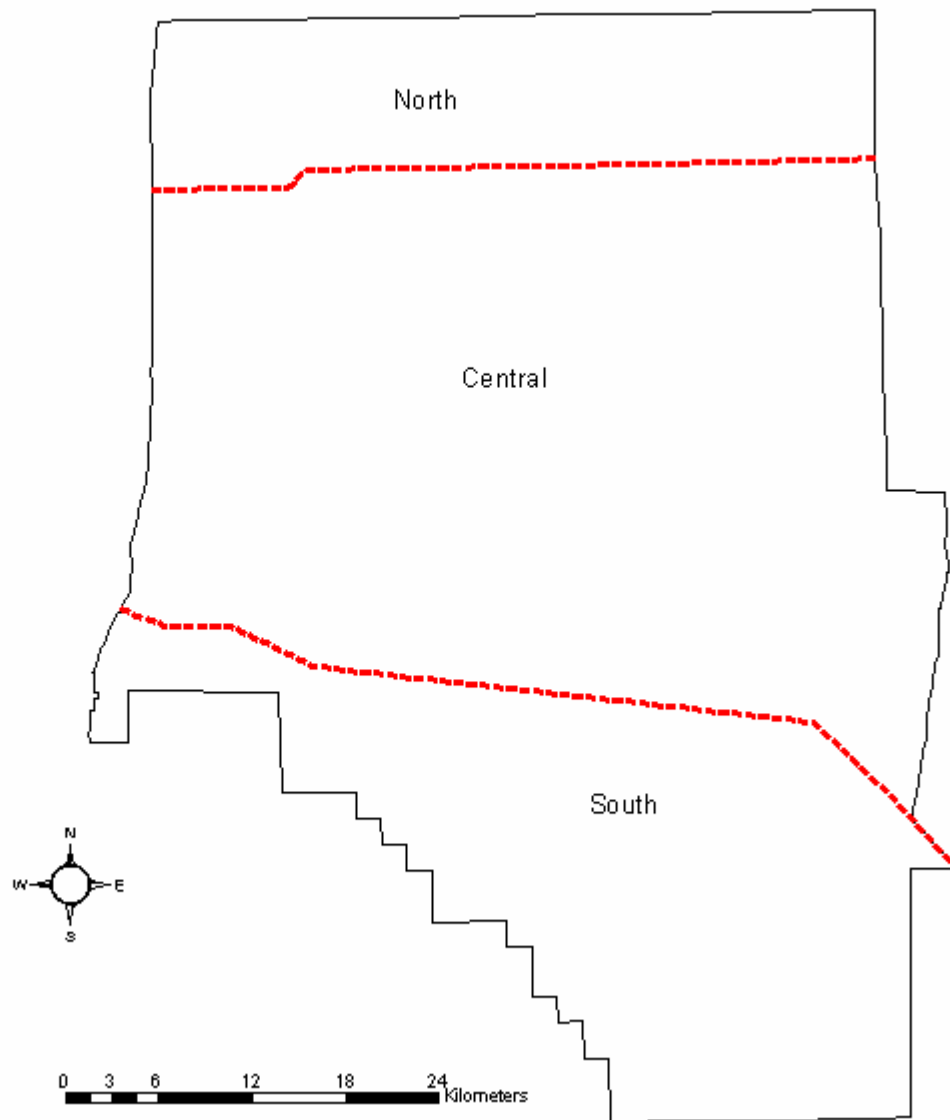


Figure 2: BICY voucher collection regions

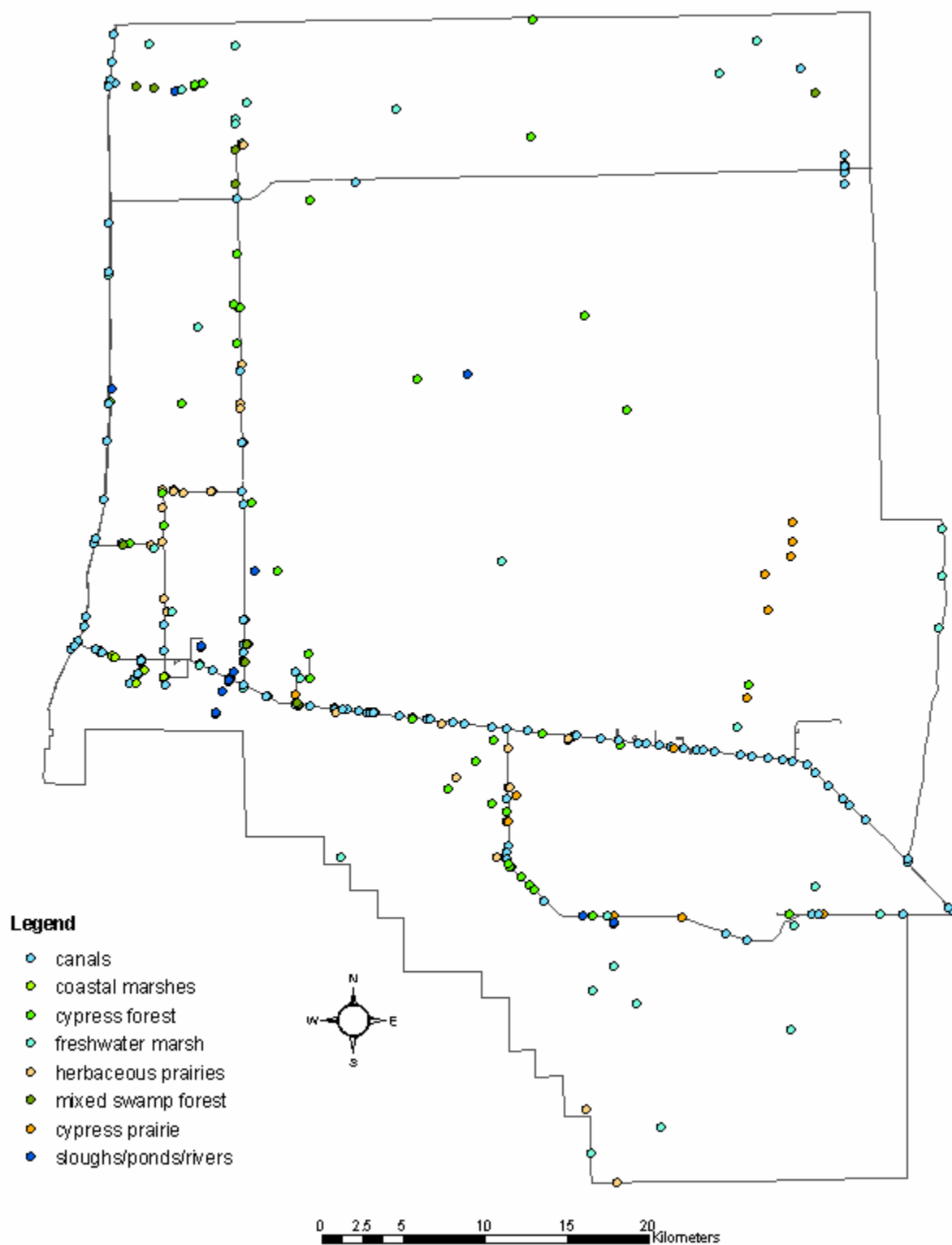


Figure 3: BICY fish I & M sampling locations, 10/02-10/03, by habitat type

## Appendix 2: Potential Big Cypress Fish List

5: Very Likely: Reported to be present in BICY

4: Likely: Found in similar habitats in nearby regions of south Florida

3: Possible: Occurs in nearby regions of south Florida

2: Not Likely: Scarce habitat in BICY or not present in nearby regions of south Florida

1: Very Unlikely: Habitat does not occur in BICY or is rarely if ever present in south Florida

FLMNH = Specimen(s) in Florida Museum of Natural History

family	common name	species	current study	5	4	3	2	1	notes
Lepisosteidae	Longnose Gar	<i>Lepisosteus osseus</i>						X	6
	Florida Gar	<i>Lepisosteus platyrhincus</i>	X	X					1
Amiidae	Bowfin	<i>Amia calva</i>	X	X					1
Elopidae	Ladyfish	<i>Elops saurus</i>	X			X			2
Megalopidae	Tarpon	<i>Megalops atlanticus</i>	X		X				2
Anguillidae	American Eel	<i>Anguilla rostrata</i>	X	X					1
Clupeidae	Gizzard Shad	<i>Dorosoma cepedianum</i>	X			X			7
	Threadfin Shad	<i>Dorosoma petenense</i>			X				8
Engraulidae	Bay Anchovy	<i>Anchoa mitchilli</i>				X			9
Cyprinidae	Golden Shiner	<i>Notemigonus crysoleucas</i>	X	X					1
	Ironcolor Shiner	<i>Notropis chalybaeus</i>						X	10
	Taillight Shiner	<i>Notropis maculatus</i>	X	X					1
	Coastal Shiner	<i>Notropis petersoni</i>	X	X					11
	Pugnose Minnow	<i>Opsopoeodus emiliae</i>					X		12
Catostomidae	Lake Chubsucker	<i>Erimyzon sucetta</i>	X	X					1
Ictaluridae	White Catfish	<i>Ameiurus catus</i>					X		13
	Yellow Bullhead	<i>Ameiurus natalis</i>	X	X					1
	Brown Bullhead	<i>Ameiurus nebulosus</i>	X	X					1
	Channel Catfish	<i>Ictalurus punctatus</i>				X			3
	Tadpole Madtom	<i>Noturus gyrinus</i>	X		X				2
Clariidae	Walking Catfish	<i>Clarias batrachus</i>	X	X					1
Ariidae	Hardhead Catfish	<i>Arius felis</i>	X		X				14
	Gafftopsail Catfish	<i>Bagre marinus</i>				X			15
Callichthyidae	Brown Hoplo	<i>Hoplosternum littorale</i>	X	X					16
Loricariidae	Vermiculated Sailfin Catfish	<i>Pterygoplichthys disjunctivus</i>						X	17
	Orinoco Sailfin Catfish	<i>Pterygoplichthys multiradiatus</i>					X		18
Esocidae	Redfin Pickerel	<i>Esox americanus</i>	X			X			19
	Chain Pickerel	<i>Esox niger</i>			X				3
Aphredoderidae	Pirate Perch	<i>Aphredoderus sayanus</i>				X			20
Atherinidae	Brook Silverside	<i>Labidesthes sicculus</i>	X	X					1
	Inland Silverside	<i>Menidia beryllina</i>	X		X				2
Apocheilidae	Mangrove Rivulus	<i>Rivulus marmoratus</i>					X		21
Fundulidae	Diamond Killifish	<i>Adinia xenica</i>		X					1
	Golden Topminnow	<i>Fundulus chrysotus</i>	X	X					1
	Marsh Killifish	<i>Fundulus confluentus</i>	X	X					1
	Gulf Killifish	<i>Fundulus grandis</i>	X			X			4
	Lined Topminnow	<i>Fundulus lineolatus</i>						X	22
	Redface Topminnow	<i>Fundulus rubrifrons</i>					X		23
	Seminole Killifish	<i>Fundulus seminolis</i>	X	X					1
	Longnose Killifish	<i>Fundulus similis</i>					X		4

## Appendix 2 cont.

family	common name	species	current						notes
			study	5	4	3	2	1	
Poeciliidae	Bluefin Killifish	<i>Lucania goodei</i>	X	X					1
	Rainwater Killifish	<i>Lucania parva</i>	X		X				1
	Pike Killifish	<i>Belonesox belizanus</i>	X	X					24
	Mosquitofish	<i>Gambusia holbrooki</i>	X	X					1
	Least Killifish	<i>Heterandria formosa</i>	X	X					1
Cyprinodontidae	Sailfin Molly	<i>Poecilia latipinna</i>	X	X					1
	Sheepshead Minnow	<i>Cyprinodon variegatus</i>	X	X					1
	Goldspotted Killifish	<i>Floridichthys carpio</i>					X		4
Belonidae	Flagfish	<i>Jordanella floridae</i>	X	X					1
	Atlantic Needlefish	<i>Strongylura marina</i>	X			X			25
	Redfin Needlefish	<i>Strongylura notata</i>	X			X			26
	Timucu	<i>Strongylura timucu</i>	X		X				1
Synbranchidae	Asian Swamp Eel	<i>Monopterus albus</i>						X	27
Elassomatidae	Everg. Pgymy Sunfish	<i>Elassoma evergladei</i>	X	X					1
Centropomidae	Common Snook	<i>Centropomus undecimalis</i>	X	X					1
	Tarpon Snook	<i>Centropomus pectinatus</i>					X		28
Centrarchidae	Bluespotted Sunfish	<i>Enneacanthus gloriosus</i>	X	X					1
	Warmouth	<i>Lepomis gulosus</i>	X	X					1
	Bluegill	<i>Lepomis macrochirus</i>	X	X					1
	Dollar Sunfish	<i>Lepomis marginatus</i>	X	X					1
	Redear Sunfish	<i>Lepomis microlophus</i>	X	X					1
	Spotted Sunfish	<i>Lepomis punctatus</i>	X	X					1
	Largemouth Bass	<i>Micropterus salmoides</i>	X	X					1
	Black Crappie	<i>Pomoxis nigromaculatus</i>	X		X				3
Percidae	Swamp Darter	<i>Etheostoma fusiforme</i>	X	X					1
Echeneidae	Sharksucker	<i>Echeneis naucrates</i>	X*					X	29
Carangidae	Crevelle Jack	<i>Caranx hippos</i>	X			X			2
Lutjanidae	Gray Snapper	<i>Lutjanus griseus</i>	X			X			30
	Striped Mojarra	<i>Eugerres plumieri</i>	X	X					1
	Spotfin Mojarra	<i>Eucinostomus argenteus</i>					X		31
	Silver Jenny	<i>Eucinostomus gula</i>				X			32
	Tidewater Mojarra	<i>Eucinostomus harengulus</i>	X			X			33
Sparidae	Sheepshead	<i>Archosargus probatocephalus</i>	X		X				1
	Pinfish	<i>Lagodon rhomboides</i>	X				X		34
Sciaenidae	Red Drum	<i>Sciaenops ocellatus</i>	X			X			2
Cichlidae	Peacock Cichlid	<i>Cichla ocellaris</i>						X	35
	Oscar	<i>Astronotus ocellatus</i>	X		X				2
	Black Acara	<i>Cichlasoma bimaculatum</i>	X	X					1
	Mayan Cichlid	<i>Cichlasoma urophthalmus</i>	X		X				36
	Jewelfish	<i>Hemichromis letourneauxi</i>	X				X		37
	Banded Sevarum	<i>Heros sevarum</i>					X		38
	Blue Tilapia	<i>Oreochromis aureus</i>	X			X			2
	Mozambique Tilapia	<i>Oreochromis mossambicus</i>						X	39
	Jaguar Guapote	<i>Parachromis managuense</i>				X			40
	Spotted Tilapia	<i>Tilapia mariae</i>	X	X					1
Mugiliidae	Mountain Mullet	<i>Agonostomus monticola</i>					X		41
	Striped Mullet	<i>Mugil cephalus</i>	X	X					1
Eleotridae	Fat Sleeper	<i>Dormitator maculatus</i>				X			42
	Spinycheek Sleeper	<i>Eleotris amblyopsis</i>						X	43
	Bigmouth Sleeper	<i>Gobiomorus dormitor</i>						X	44
Gobiidae	Frillfin Goby	<i>Bathygobius soporator</i>	X					X	45
	Crested Goby	<i>Lophogobius cyprinoides</i>	X			X			2



## Appendix 2 cont.

family	common name	species	current						notes
			study	5	4	3	2	1	
Achiridae	Naked Goby	<i>Gobiosoma bosci</i>			X				46
	Clown Goby	<i>Microgobius gulosus</i>	X			X			5
	Lined Sole	<i>Achirus lineatus</i>				X			47
	Hogchoker	<i>Trinectes maculatus</i>	X		X				5
<b>Current Total:</b>			<b>64</b>	37	14	21	13	11	

Species known in BICY (Column 5) =	37
Low range	
Species probably in BICY (Columns 5+4) =	51
Species possibly in BICY (Columns 5+4+3) =	72
Max. species possible (Columns 5+4+3+2) =	85
High range	

### Notes:

- 1: Present in Big Cypress (Loftus & Kushlan 1987)
- 2: Present in ENP (Loftus & Kushlan 1987)
- 3: Present in ENP (Loftus & Kushlan 1987) and Lake Trafford (Morello pers. comm.)
- 4: Present in Everglades drainage, Collier county (FLMNH) and ENP (Loftus & Kushlan 1987)-primarily marine
- 5: Present in Everglades drainage, Collier county (FLMNH) and ENP (Loftus & Kushlan 1987)
- 6: Present in Lake Okeechobee (FLMNH), And Water Conservation Area 2a (Dineen 1974) \*\* Few records in south Florida
- 7: Present in Lake Okeechobee (FLMNH) and Homestead canals (Loftus & Kushlan 1987) \*\* Few records from south Florida, but may enter L-28 canal.
- 8: Present in Tamiami Canal ENP (Loftus & Kushlan 1987) and Lake Trafford (Morello pers. comm.)
- 9: Present in Everglades drainage Collier county (FLMNH), ENP (Loftus; Tabb & Manning 1961)  
\*\* Primarily marine.
- 10: Present in Lake Okeechobee (FLMNH) \*\* No records south of Lake Okeechobee.
- 11: Present in Big Cypress (Kushlan and Lodge 1974)
- 12: Present in Big Marco Pass drainage??, Collier county and Lake Okeechobee (FLMNH) \*\* Validity of Collier county record unknown, no other records south of Lake Okeechobee.
- 13: Present in Lake Okeechobee (FLMNH) and Lake Trafford (Morello pers. comm.) \*\* Few records in south Florida
- 14: Present in ENP (Loftus & Kushlan)
- 15: Present in ENP (Loftus & Kushlan 1987) \*\* Primarily marine.
- 16: Present in Lake Trafford (Morello pers. comm.) & collected by USGS researchers in Big Cypress
- 17: Present in Tampa Bay drainage (FLMNH) \*\* No records in south Florida.
- 18: Present In Dade and Broward county (FLMNH) and Lake Trafford (Shafland pers. comm.)
- 19: Present in ENP (Loftus pers. com.) and Lake Trafford (Morello pers. comm.) \*\* Few records south of Lake Okeechobee.
- 20: Present in ENP (Loftus pers. comm.) \*\* Few records south of Lake Okeechobee.
- 21: Present in ENP (Tabb & Manning 1961) \*\* Primarily marine.
- 22: Present in Lake Okeechobee drainage (FLMNH) \*\* No records south of Lake Okeechobee.
- 23: Present in Lake Trafford (Gilbert et al. 1992) \*\* Lack of information on this species.
- 24: Present in Big Cypress (<http://nas.er.usgs.gov>)
- 25: Present in Lake Okeechobee and Collier county coastal waters (FLMNH), ENP (Odum 1971, Tabb 1974)
- 26: Present in ENP (Tabb et al. 1974)
- 27: Present in east coast canals \*\* Has not been found outside of canals in Dade county
- 28: Present in ENP (Tabb 1974) \*\* Few records from SW gulf coast

## Appendix 2 cont.

- 29: \*\* Rare in freshwater; was not on list prior to sighting
- 30: Present in ENP (Tabb and Manning 1961; Odum 1971; Tabb 1974)
- 31: Present in Everglades drainage, Collier county (FLMNH) \*\* Primarily marine, *E. harengulus* apparently replaces this species in low salinity waters.
- 32: Present in ENP (Loftus, Odum 1971; Tabb et al. 1974; Kushlan & Lodge 1974) \*\* Primarily marine.
- 33: \*\* No local records, but records of *E. argenteus* in south Florida freshwaters may be this species.
- 34: Present in Florida freshwaters (FLMNH) \*\* Primarily marine
- 35: Present in east coast canals (FLMNH) \*\* Has not spread from east coast canals.
- 36: Present in ENP (Loftus 1987)
- 37: Present in east coast canals and ENP (Loftus & Kushlan; FLMNH) and Lee County (<http://www.swfwc.org/ANS>) \*\* These populations may be spreading
- 38: Present in east coast canals and ENP (Loftus; FLMNH) \*\* Has not spread far from east coast canals.
- 39: Present in east coast canals (Loftus & Kushlan; FLMNH) \*\* Has not spread from east coast canals.
- 40: Present in east coast canals and ENP (Loftus; FLMNH) \*\* Has begun to spread west into ENP
- 41: Present in south Florida freshwaters (Loftus & Kushlan 1987) \*\* No records from SW gulf coast
- 42: Present in ENP (Tabb & Manning 1961; Tabb et al. 1967) and Big Marco Pass drainage (FLMNH) \*\* Few records from SW gulf coast
- 43: Present in Florida freshwaters (FLMNH) \*\* No records from SW gulf coast
- 44: Present in east coast canals (Loftus & Kushlan; FLMNH) \*\* No records from SW gulf coast
- 45: \*\* Rare in freshwater; was not on list prior to collection
- 46: Present in Big Cypress (Loftus & Kushlan 1987)-record is from brackish water
- 47: Present in Everglades drainage, Collier county (FLMNH) and ENP (Tabb & Manning 1961; Odum 1971; Tabb et al. 1974; Kushlan & Lodge 1974)